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ABSTRACT

Described is a study intended to evaluate a simulation exercise which was part of an environmental education program integrating courses and mini-courses for environmental awareness into existing curricula. Nine teachers and the associated 17 classes and 413 eleventh-grade biology students made up the study population. Techniques of treatment, control, and statistical analysis are detailed. Conclusions, implications, and recommendations for further research are provided. (RE)

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THE SUITABILITY OF THE ENVIRONMENTAL ISSUES SERIES (EIS) FOR THE GRADE XI BIOLOGY CLASSROOM

Barry A. Mitschke

S.S.T.A. Research Centre Report No. 50

A report with recommendations prepared under the auspices of the Saskatchewan School Trustees Association Research Centre.

April, 1978

Note: The opinions expressed in this report are those of the author and may or may not be in agreement with SSTA officers or trustees, but are offered as being worthy of consideration by those responsible for making decisions.

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BIOGRAPHICAL SKETCH

Raised on a mixed farm near Langenburg, Saskatchewan, the investigator completed both elementary and secondary school at Langenburg. After obtaining a B.A. (University of Saskatchewan) with a biology and chemistry major, Mr. Mitschke completed a successful year of Medicine in Saskatoon in 1967. He was married the same year and worked for two years at the Education Library, University of Saskatchewan, Regina Campus before completing an Education degree there in 1970. Mr. Mitschke taught junior science and biology at Sheldon-Williams Collegiate in Regina from 1970-1976. A sabbatical was granted for the school year 1976-1977 so that he could complete a Master of Education degree at the University of Regina. He is currently teaching at Sheldon-Williams Collegiate. His pastimes relate mainly to environmental education, and include camping, canoeing, cross-country skiing and photography.

TABLE OF CONTENTS

A.	The Most Important and Significant Finding and/or Implication of the Study	1
B.	Purpose of the Study	1
C.	Procedures and Sample Used	2
D.	Major Findings	4
E.	Conclusions	4
F.	Implications and Further Research	8
G.	Recommendations for Practice	9

A. THE MOST IMPORTANT AND SIGNIFICANT FINDING AND/OR IMPLICATION OF THE STUDY

The Wetlands Management case study (or Mini-Course) can be integrated successfully intc Grade XI biology classrooms. The Mini-Course materials are suitable and the simulation strategy appropriate. Teachers and students enjoyed the active involvement and the experience was judged worthwhile.

B. PURPOSE OF THE STUDY

In 1973 the Saskatchewan Department of Education Advisory Committee on Environmental Education recommended that:

(a) educators incorporate and integrate an "environmental emphasis" into existing courses and programs and

(b) special courses and mini-courses have a definite role in fostering environmental knowledge and environmental awareness.

Also in 1973, the Director of the Public Information and Education Branch of Environment Saskatchewan hired several teachers to write four case studies for a Saskatchewan Environmental Issues Series (EIS). Within each case study, students, using a simulation process, assume the roles of people who are seeking to solve a complex environmental issue. Using problem-solving techniques, the students have to resolve the issue and come to a compromise decision.

There was a need to formally evaluate a case study, to find support for the Advisory Committee's recommendations, to involve teachers and students in educational research, and to promote the aims of environmental education. The Wetlands Management case study was chosen for the investi-

gation.

The investigation was guided by five sub-problems:

1. to determine the suitability of the materials,
2. to assess the appropriateness of the simulation strategy,
3. to measure the effects of the Mini-Course on the students'
   (a) environmental knowledge
   (b) environmental attitude and
   (c) critical thinking ability,
4. to gather teacher and student opinions about the experience, and
5. to analyze some of the classroom situation and verbal interactions.

C. PROCEDURES AND SAMPLE USED

Nine teachers from seven Regina-area high schools with their 413 grade XI biology students in 17 classes volunteered for the investigation. A quasi-experimental nonequivalent control group design and a curriculum evaluation model guided the investigation and particularly, the administration of instruments for data collection. See Table 1 for details.

The teachers were randomly assigned to Treatment Groups. Quantitative data collection instruments used were the EAI, EST and CCTT plus the CVC tapes (CERLI Verbal Classification system used by the STF in the Teaching-Learning Conditions Project). Other instruments were investigator designed.

Student performance data from the EAI, EST and CCTT were analyzed using the Statistical Package for the Social Sciences (SPSS) computer programs dealing with description, correlation and the analysis of covariance. STF teacher-raters analyzed the CVC tapes, and the investigator analyzed all remaining data.

Table 1

Design of the Investigation and Data Collection Instruments[a]

Treatment Groups	Aspects of the Design					
	Treatment and Data Collection			Other Data Collection		
	Orientation Workshop	Wetlands Management Mini-course	Investigator's Visitations	Teacher Data	Student Data	Evaluation Workshop
A	6-7; 14[a]	11	12	8; 13(4)	1-5	9-10
B	6-7; 14	11	none	8; 13(4)	1-5	9-10
C	none	none	none	7-8; 13(2)	1-5	none

[a] Arabic numbers refer to the KEY below.

KEY Data Collection Instruments:

1. Environmental Attitude Inventory (EAI)
2. Environmental Science Test (EST)
3. Cornell Critical Thinking Test (CCTT)
4. Student Answer Sheet
   (a) Sex (b) Rural-Urban
5. Student IQ Data
6. Evaluation of Orientation Workshop
7. Teacher Profile
8. Timing and Coverage
9. Teacher Post-Investigation Interview
10. Teacher Feedback Opinionnaire
11. Student Feedback
12. Investigator's Notes
13. CVC Tapes (Number)
14. Case Study Consent Form

D. MAJOR FINDINGS

A number of key criteria had been set before the investigation in order to judge the effect of the Mini-Course. Table 2 enumerates these criteria and summarizes the major findings of the investigation specifying how well the criteria were met.

E. CONCLUSIONS

The materials of the Mini-Course were judged as suitable for the grade XI biology classrooms. This suitability would be increased if the few gaps in information were filled, and if the visual difficulties with the map and slides were corrected. It is suggested that some of the student problems with the materials were not caused by the materials themselves, but could be attributed to student weaknesses in research skills, namely, extracting, interpreting, organizing and summarizing data for their roles. Similarly, it is suggested that some of the teachers' frustrations with the students were caused by the "newness" of the materials and strategy, and by the fact that the teachers had no background experience (other than the Orientation Workshop) to help them solve student problems and to find supplementary material or information. The relevancy of and motivation provided by a Saskatchewan environmental issue was evident.

The simulation strategy was judged as appropriate for the grade XI biology classrooms. It is suggested that because the students were so actively involved and having fun, their learning was enhanced, and enjoyable, and they welcomed the change from "regular" classes. Even though the criterion tests found no changes in environmental attitude, environmental knowledge and critical thinking ability because of the Mini-Course,

TABLE 2

Effects of the Investigation: Major Findings (Criteria Met)

CRITERIA SET	MET
SUITABILITY OF MATERIALS	
1. Less than 6 major categories of problems would be encountered e.g. vocabulary; interpretation of tables.	1. 5 categories were encountered.
2. 2/3 AIMS and OJBECTIVES achieved.	2. 5/6 AIMS and 2/3 OBJECTIVES achieved.
3. To study a Saskatchewan environmental issue--chosen as an important AIM.	3. This AIM was ranked third of six.
4. "Regular" students would not outperform Mini-Course (the experimental) students.	4. True.
APPROPRIATENESS OF SIMULATION	
1. The advantages would outweigh the disadvantages.	1. On a teacher checklist, the 9 advantages received 44 checks; the 8 disadvantages recieved 12 checks.
2. 75% of the student comments would be favourable.	2. 93% were favourable.
3. Less than 6 major categories of problems.	3. 5 categories encountered.
4. Participants would enjoy the "involvement".	4. Enjoyment was expressed.
OTHER EFFECTS OF THE TREATMENT	
1. 2/3 of the teachers would judge the Oreientation Workshop as adequate and useful.	1. 2/3 or greater.
2. 65% of the student comments would be favourable.	2. 84% were favourable.
3. All 6 teachers would use the Mini-Course again.	3. All 6 specified this.
4. Teachers would become more indirect.	4. Teachers (a) dealt less with facts and (b) rejected students less which indicated indirectness.
5. Students have more interactions per minute.	5. Approximately 4x as many.
6. Teachers and students would reverse roles on CVC dimensions.	6. Roles were reversed on three dimensions (a) dealing with facts, (b) informing, and (c) rejecting.
7. Workshop benefits would be expressed.	7. Seven benefits were stated.
8. Students perceived changes in classmates and teachers.	8. True.
9. Teachers perceived self-change.	9. True.

many other types of incidental learnings and experiences were exhibited and suggested by the participants. Among these learnings and experiences were: an increased awareness of the complexity of an environmental issue; more self-confidence; a change to practice social and communication skills--cooperating, persuading, making a decision, problem solving, critical thinking, writing and presenting briefs; consideration of and exposure to differing viewpoints; and playing a different role in the Mini-Course, hence in the classroom. It is suggested that the "newness" of the strategy caused teachers to have problems with the logistics (timing and scheduling) of the Mini-Course which should be solved with more experiences with the strategy. Furthermore, it is suggested that the need to motivate all students to participate is inherent in every teaching strategy, not just simulation. The simulation strategy is considered to be a worthwhile addition to a teacher's repertoire of strategies.

Based on teacher feedback, it appears that the Mini-Course can be successfully integrated into the biology courses. This integration--backed by the judged suitability of materials and appropriateness of simulation--fulfills the Advisory Committee's recommendation that educators incorporate and integrate environmental education materials into existing courses.

No statistical support can be given to the Saskatchewan Advisory Committee on Environmental Education recommendation that special courses or "mini-courses" have a definite role to play in fostering environmental knowledge and environmental awareness. The Mini-Course did not cause any

significant differences in the students' environmental attitude, environmental knowledge and citical thinking ability over 10 hours of classroom activity as compared to the "regular" biology classes. In relation to this recommendation, the Mini-Course maintained a level of student knowledge and awareness but did not foster an increase. In addition, it can be concluded that students' sex or rural-urban location had no significant effect on these variables. The significant links between environmental knowledge and critical thinking ability, although not cause-effect, suggest that environmental simulations would be valuable additions to environmental education curricula, such as environmental biology. Agreements and disagreements between the current findings and previous research were found for these student performance variables.

The Mini-Course experience, in general, was considered worhwhile for the participants. The students learned actively and had fun doing it. Classroom perceptions of others were enhanced. Social interactions and communication skills were practiced. The in-service Orientation Workshop for teachers adequately met their needs for easier involvement. The majority of the AIMS and OBJECTIVES were achieved. All six teachers would use the Mini-Course again. However, all of the evaluation (testing and forms) demanded by the investigator, which were not part of the Mini-Course, was deemed a necessary "evil" by the participants and was the least enjoyable experience of the investigation.

As an hypothesis, the investigator suggests that a more important reason than a teacher's experience for differences found between classroom situations is the situation itself--facilities, resources and students present. The most inexperienced teacher in the investigation was just as, if not more so, eager, enthusiastic, environmentally aware and

willing to take a risk as were the experienced teachers, even though the "polish" and logistical abilities were not as good. The situation of the least experienced teacher was rated and observed to be the least conducive to learning: facilities were poor; resources were deficient; and many students were apathetic.

Visitations by the investigator-consultant were considered to have little impact on the participants of Treatment Group A. The investigator suggests that a more important impact on the teacher was caused by the in-service Orientation Workshop and that a more important impact on all participants was caused by the methodological orientation provided by the Mini-Course materials and simulation strategy. The investigator's visitations did serve the function of gathering some "naturalistic" observations.

Another conclusion relates to classroom interactions. The results obtained from the audio-taping of random "regular" biology classes and random Mini-Course classes support the suggestion that the methodological orientation of the Mini-Course materials and simulation strategy caused a shift in student-teacher roles. Teachers talked less, had fewer interactions per minute, dealt less with facts, informed more and rejected students less during the Mini-Course; students did the reverse. All of these role changes, except informing more, are indicative of indirect influence which should lead to increased student participation and the learning of attitudes and knowledge.

F. IMPLICATIONS FOR FURTHER RESEARCH

Based on the investigation happenings, feedback, results and conclusions, 22 questions were specified which may be answered by further re-

search. For convenience, these 22 questions were grouped as follows: classroom interactions; curriculum; environmental education; general; simulation; student behaviour; teacher behaviour; teaching strategies; and thinking ability.

G. RECOMMENDATIONS FOR PRACTICE

In view of the results and conclusions of the investigation, the following recommendations are in order, especially those that apply to the teachers and schools involved.

1. Problems with the Mini-Course materials should be corrected or supplements should be provided to make the Mini-Course materials even more suitable than at present.

2. All the EIS case studies, which are built on the identical model as that of the Mini-Course, should be made available with the Department of Education assuming this responsibility.

3. Teachers should be encouraged to use the Mini-Course in future years with their grade XI biology classes.

4. Teachers should be encouraged to use the EIS Mercury Pollution, Pesticides, and Qu'Appelle Basin case studies in their biology courses.

5. Other case studies should be written on other relevant Saskatchewan environmental issues using the model employed for the first four case studies. The Department of Education together with other interested institutions, should show leadership by spearheading this development.

6. The suitability of the EIS case studies should be assessed in other subject areas, for example, chemistry, physics, geography and home economics.

7. Because the simulation strategy has been judged appropriate, biology teachers should strive to use the simulation strategy at least once per year to gain more skill in its use.

8. Teachers should try to develop environmental knowledge, environmental attitude and critical thinking tests which would more adequately measure these dimensions deemed learnable in the EIS case studies.

9. Teachers should be encouraged to become involved with the STF teaching-learning conditions project. By audio-taping their classes and applying the feedback, teachers should be able to change their verbal behaviours toward those dimensions of indirect influence considered worthwhile and established by research.

10. Teachers should continue to take the risk of involvement in participatory educational research, in-service, and other professional development activities so that they and their students may remain current, enjoy variety, and share experiences and feedback as they learn and grow together..